

1. The method of forming hydrogen from a gas mixture of methane and carbon dioxide comprising contacting gas said mixture with a catalyst comprising molybdenum carbide having a surface area of at least 35 m²/g.

2. The method claimed in claim 1 wherein said catalyst has a surface area of at least about 50 m²/g.

3. The method claimed in claim 1 wherein said gas mixture has a ratio of carbon dioxide to methane of from about 1 to 10 to 10 to 1 by volume.

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4. The method claimed in claim 3 wherein said reaction is conducted at a temperature of about 700° to about 900°C.

5. The method of conducting a water gas shift reaction comprising contacting a gas comprising a mixture of hydrogen, carbon monoxide and water vapor at a temperature of about 200° to 550°C in contact with a catalyst said catalyst comprising molybdenum carbide.

6. The method claimed in claim 5 wherein said molybdenum carbide has a surface area greater than 35 m²/g.

7. A method of utilizing a molybdenum carbide catalyst in a reaction vessel having a controlled atmosphere comprising:

passivating said molybdenum carbide catalyst to form oxides on surfaces of said molybdenum carbide catalyst;

5 introducing said molybdenum carbide catalyst into a reaction vessel;

activating said molybdenum carbide catalyst by passing a carburizing gas in contact with said catalyst at an elevated temperature effective to activate said catalyst.

8. The method claimed in claim 7 further comprising passing a carbon containing gas in contact with said catalyst to form a reaction whereby a said catalyst is at least partially deactivated; further comprising reactivating said catalyst by introducing a carburizing gas into said reaction vessel in contact with said catalyst at a temperature effect to reactivate said catalyst.

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9. A method of forming a high surface area Mo_2C comprising soaking a molybdenum compound selected from the group consisting of molybdates and oxide in a H/CO gas at $300^\circ\text{--}400^\circ\text{C}$ for 1-5 hours;

5 subsequently soaking said molybdenum compound in a H/CH_4 mixture for 3-5 hours at a temperature of $550^\circ\text{--}850^\circ\text{C}$.